CLAIMS

What is claimed is:

1. A method for combining independent scene layers to form computer generated environments, comprising the steps of:

constructing a terrain layer using stored terrain data;

generating a feature layer using feature layer data that is stored separately from the stored terrain data; and

combining the feature layer and the terrain layer to form a composite environment.

2. A method as in claim 1, further comprising the step of rendering the composite environment for viewing.

3. A method as in claim 1, wherein the step of generating a feature layer further comprises the step of generating a plurality of feature layers that are configured to be combined together with other feature and terrain layers.

4. A method as in claim 1, further comprising the step of determining the locations of features in the feature layer in reference to the terrain layer.

5. A method for combining scene layers from independent databases to form a computer generated environment and associated images, comprising the steps of:

processing a terrain database containing terrain data;

constructing a terrain layer that is stored in a data structure, and the terrain layer is constructed using the terrain data;

processing a feature layer database containing feature data;

generating a feature layer using the feature data that is separate from the terrain data, wherein features in the feature layer have locations in reference to the terrain layer;

combining the feature layer and the terrain layer to form a composite environment; and

rendering the composite environment for viewing by a user.

6. A method as in claim 5, wherein the step of generating a feature layer further comprises the step of generating a plurality of feature layers which are applied to the terrain layer.

7. A method as in claim 5, further comprising the step of using a different level-of-detail strategy for the feature layer than for the terrain layer.

8. A method as in claim 5, further comprising the step of using a different field-of-view culling strategy for the feature layer than for the terrain layer.

9. A method as in claim 5, further comprising the step of storing the terrain layer in a data structure that is a quadtree.

10. A method as in claim 9, further comprising the step of appending features from the feature layer to the quadtree at appropriate terrain facets.

11. A method as in claim 9, further comprising the step of checking prior features added to the quadtree to determine whether special processing should be applied to additional features being appended to the quadtree.

12. A method as in claim 5, further comprising the step of creating an instantaneous model of the terrain using a triangular mesh based on an instantaneous eyepoint.

13. A method as in claim 12, further comprising the step of creating a triangular mesh using a level-of-detail (LOD) strategy that partitions triangles based on the eyepoint location with respect to the triangles.

14. A method for combining scene layers from independent databases to form a computer generated environment and associated images, comprising the steps of:

forming a terrain layer using a terrain database;

processing a two-dimensional feature layer to determine a location of the two-dimensional features in the terrain layer;

processing a three-dimensional feature model layer to determine a location of the three-dimensional feature models in the terrain layer;

applying the two-dimensional feature layer and three-dimensional feature model layer to the terrain layer to form a composite environment;

rendering the composite environment for viewing by a user.

15. A method as in claim 14, wherein the steps of processing a two-dimensional feature layer and processing a three-dimensional feature model layer, further comprise the step of processing a plurality of feature layers which are applied to the terrain layer.

16. A method as in claim 14, wherein the step of processing a two-dimensional feature layer further comprises the step of computing a two-dimensional feature layer selected from the group of two-dimensional features consisting of terrain modifiers, terrain texture, terrain co-planars, model texture, point features, lineal features, areal features, sky, roads, runways, and shadows.

17. A method as in claim 14, wherein the step of processing a three-dimensional feature layer further comprises the step of processing a three-dimensional feature layer selected from the group of three-dimensional features consisting of buildings, trees, foliage, vehicles, utility structures, road cuts, craters, land fills, airport skirts, and people.

18. A system for combining independent scene layers to form computer generated environments, comprising:

a terrain database configured to store a terrain layer;

a feature database that is separate from the terrain database and configured to store a feature layer; and

a scene assembler configured to receive the terrain layer from the terrain database and the feature layer from the feature database in order to combine the terrain layer and the feature layer into a composite environment.

19. A system as in claim 18, a real-time system configured to generate polygons for the composite environment of each computational image frame.

20. A system as in claim 18, further comprising an associated processor for the feature database configured to submit features from the feature database to the scene assembler.

21. A system as in claim 18, further comprising an associated processor for the terrain database configured to submit the terrain layer to the scene assembler.

22. A system as in claim 18, further comprising a quadtree terrain data structure that defines instantaneous terrain geometry.

23. A system as in claim 18, wherein the feature database further comprises a plurality of feature databases that are configured to be combined together and applied to the terrain data structure.

24. A system as in claim 22, wherein the plurality of feature databases further comprises a plurality of 2-D feature databases and a plurality of 3-D feature databases.

25. A system as in claim 24, wherein the plurality of 2-D feature databases are selected from the group of 2-D feature databases consisting of a model texture database, a terrain texture database, a road feature database, a runway feature database, and a shadow feature database.

26. A system as in claim 24, wherein the plurality of 3-D feature databases are selected from the group of 3-D feature databases consisting of a building database, a tree database, a foliage database, a vehicle database, a utility structure database, a road cut database, a crater database, a land fill database, an airport skirt database, and a people database.

27. The system as in claim 23, further comprising the step of providing a level-of-detail control for the terrain layer and a separate level-of-detail control for each of the plurality of feature databases.

28. A method for combining independent scene layers to form a computer generated environment and associated images, comprising the steps of:

processing a terrain database to form a terrain layer;

storing the terrain layer in a tree data structure;

processing a feature database to form a feature layer;

applying the feature layer to the terrain layer to form a composite environment;

rendering the composite environment for viewing by a user.

29. A method as in claim 28, further comprising the step of appending features from the feature layer to terminal nodes in the tree data structure based on where the features are located on the terrain layer.

30. A method as in claim 28, further comprising the step of appending coplanar polygons to the terrain nodes of the tree data structure that the coplanar polygons cover.

31. A method as in claim 28, further comprising the step of appending feature polygons to the tree data structure based on the terminal node of the terrain where the feature polygons are located.

32. A method as in claim 28, further comprising the step of storing the terrain layer in the tree data structure that is a quadtree.

33. A method as in claim 32, further comprising the step of searching the quadtree in order to determine a terrain facet where each feature is located on the terrain layer.

34. A method as in claim 33, further comprising the step of computing the position and height of a feature within the terrain facet where the feature is located.

35. A method as in claim 28, further comprising the step of processing a plurality of feature layers which are applied to the terrain layer.

36. A method as in claim 28, further comprising the step of conforming features to the terrain layer by clipping feature polygons to terrain facets.

37. A method as in claim 28, further comprising the step of transferring terrain characteristics from the terrain to features in the feature layer.

38. A method as in claim 28, further comprising the step of transferring shadow and shading terrain characteristics from the terrain layer to the feature in the feature layer.